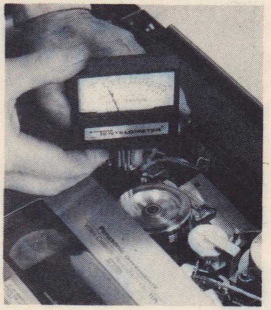
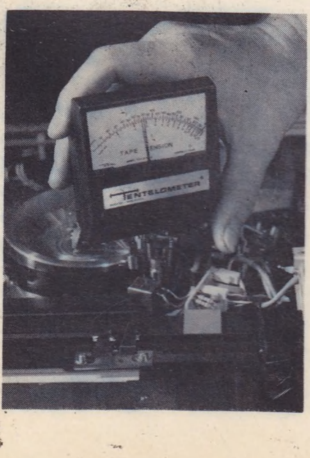
# TENTEL TAPE TIPS and TENTELOMETER® Tape Tension Gage Instruction Manual

*The user proven tape tension gage for diagnosing problems in your tape transport . . .*



TENTEL



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# TABLE OF CONTENTS

Page No.

Operating Instructions . . . . 2

Calibration . . . . 3

Audio . . . . 4, 5, 6

Beta . . . . 7

VHS . . . . 8, 9

U-matic . . . . 10, 11

1″ Video . . . . 12, 13

Quad . . . . 14, 15

Repair/Service . . . . 16

Warranty . . . . 16

Written by Wayne B. Graham Tentel Corp.

# OPERATING INSTRUCTIONS

The TENTELOMETER measures in-line tension directly merely by sliding the probes over the tape. The gage operates accurately with the gage in any orientation. There are three important factors for accurate readings

1) The tape is anywhere along the straight portion of the probes but past the rounded lead-in.

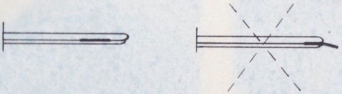


*Fig. 1*

2) The tape is in contact with all three probes.

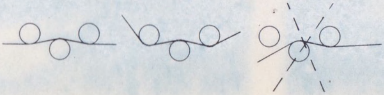


*Fig. 2.*

3) The gage is calibrated on the tape on which it will be used. This negates the effect of tape stiffness from the reading.

## CALIBRATION

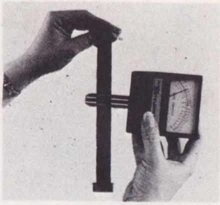


*Fig. 3*

Tension is merely the "Pull" in the tape being measured. Since the gage measures tension by detecting the force exerted against the center probe, the gage cannot differentiate between tape stiffness and tape tension. Tape stiffness must therefore be negated from the reading allowing pure tension to be monitored. This can be achieved by using a known weight (as supplied with the TENTELOMETER) suspended on a short length of tape similar to the tape on which readings are to be made. (*see fig. 3*) Set the TENTELOMETER to read the value of the weight, thus the effect of tape stiffness is eliminated from the reading. This method can also be used to assure that the gage is operating properly after minor bumps. With the weight suspended on a sample of the tape, slide the gage over the tape and move the gage up and down slightly, noting the average reading of the pointer. For maximum accuracy from gages without ball bearing rollers, calibrate the gage with the tape moving in the same direction thru the probes as the tape will be moving in the machine. If recalibration is necessary insert the 3/32 Allen wrench through the access hole in the side of the case, engage the screw and rotate clockwise to increase the reading or counterclockwise to decrease the reading. *(see fig. 4)* If the gage cannot be calibrated in this manner, return it to the factory for repair.

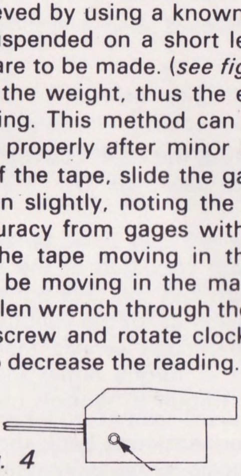


*Fig. 4*

FIELD SERVICE SHOULD NOT BE ATTEMPTED AS SEVERE DAMAGE COULD RESULT FROM IMPROPER ADJUSTMENTS INTERNALLY: AND OPENING THE UNIT DAMAGES THE CASE AND VOIDS THE WARRANTY. See Page 16 for Repair Service Information.

Additional Features:

1) The TENTELOMETER is provided with an overload stop to prevent damage during high transient starting tensions.
2) The measuring probes start and remain parallel, therefore once inserted there is minimal effect on tape tracking.
3) On TENTELOMETERS equipped with all three rotating rollers, there is virtually no drag induced on the tape handling system or servo.

# AUDIO

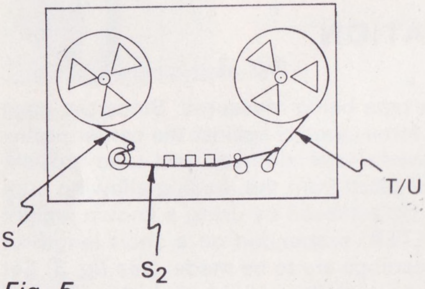


*Fig. 5*

Recommended Gages
In Order of Preference . . .

1. T2-H20-ML
2. T2-H12-ML
3. T2-H15-UM
4. T2-H7-UM
5. T2-H15-U
6.* T2-H20-1
7.* T2-H20-2

1) Calibrate the TENTELOMETER on a sample of the tape on which it will be used. (*fig. 3*)

2) There are two basic tension measurements which determine the running condition of the audio transport. The supply or holdback tension and the take-up tension. Since it is virtually impossible to list readings for the various audio recorders, it is recommended that the particular service manual be referenced. Readings are often given as torque rather than a tension. It is fairly easy to convert from torque to tension using the following aid.

   If the instruction book shows an N.A.B. hub, piece of string and a fish scale for measuring tension then chances are, the machine is of the older constant *Torque* design; thus tension (or head to tape pressure) changes proportionately with the radius of the tape pack.

Example: Torque = Tension X Pack Radius
With a string around an N.A.B. hub (3" diameter) you are to measure 6 ounces using a fish scale.

Thus: Torque = 6 oz. X 3"/2 = 9 in. oz.
(Radius = Diameter ÷ 2)
Torque is force or tension acting thru a distance.

# AUDIO

Now using a TENTELOMETER, the tension will vary depending upon the tape pack diameter but this tension can be calculated by measuring the tape pack diameter, divide by 2 to get the radius and then dividing this number into the torque value obtained as above to get the proper tape tension. (This isn't as complex as it first may sound.)

Tension = Torque ÷ Pack radius = Torque ÷ Pack Diameter ÷ 2

If the machine is of the newer constant tension type, then the TENTELOMETER can be utilized directly without conversion and can be used to verify if in fact the tension is remaining constant. Shuttle the tape through the machine and measure tension (in the play mode) at a point near the heads to ensure the same tension throughout the reel of tape.

Of utmost importance is a non-oscillating supply (holdback) tension as measured at $S_2$ in fig. 5. Oscillations at this point indicate a problem effecting wow and flutter in the head area and the TENTELOMETER can be used to diagnose sources of such problems. By inserting the TENTELOMETER at various points in the tape path, the source can usually be isolated. Similar thinking applies to the take-up side since it is essentially isolated from the supply side by the pinch roller and capstan and can have a vastly different tension from the supply side.

The following tables should be used where no service or instruction manual is provided.

---

* May be preferred if probes can fit spaces where tension measurements are desired.

# AUDIO

| Symptom or Problem | Probable Cause |
|---|---|
| TENTELOMETER pointer oscillates fairly slowly and rhythmically. | 1) Bent or warped reel<br>2) Servo Problem |
| TENTELOMETER pointer oscillates one to three times per second. | 1) Flat or bad spot on the pinch roller<br>2) Rotating guide with bad bearing. |
| TENTELOMETER pointer oscillates quite fast, pointer is almost a blur. | 1) Out of round capstan<br>2) Problem with the supply clutch or hold-back motor. |
| Pointer oscillates erratically. | 1) Servo Problem<br>2) Faulty hold-back motor<br>3) Dirty bearings in idler causing erratic rotation. |
| Tension is too low but steady. | 1) Possible inadequate head to tape contact with subsequent loss of high frequency. |
| Tension is too high but steady. | 1) Increased head to tape contact causing undue head, tape and guide wear. |

| Tape Width | Normal Tension | Tension Range |
|---|---|---|
| ¼″ (.250″) | 3 oz. | 1 to 4 oz. |
| ½″ (.50″) | 5 oz. | 2 to 8 oz. |
| 1″ | 8 oz. | 4 to 12 oz. |
| 2″ | 12 oz. | 8 to 16 oz. |
| 3″ | | |

# BETA

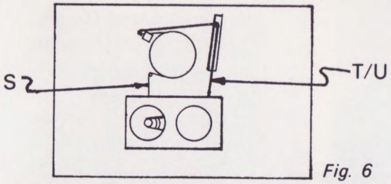


*Fig. 6*

Recommended Gages
In Order of Preference . . .

1) T2-H7-UM
2) T2-H12-ML
3) T2-H15-UM
4) T2-H5-ML
5) T2-H20-ML

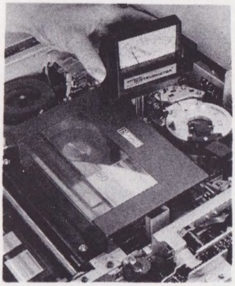


*Fig. 7*

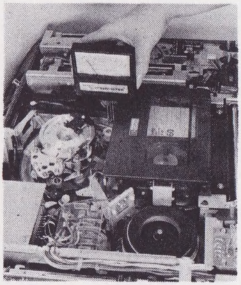


*Fig. 8*

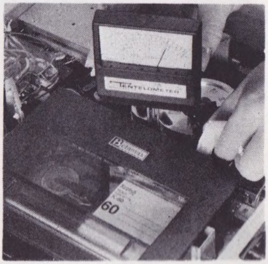


*Fig. 9*

1) Calibrate the TENTELOMETER on a sample of the ½" Beta tape similar to the tape the gage will be used on in the machine. (*see fig. 3*)
2) The basic quick check is for proper supply (hold-back) and take-up tension. Using a 2 hour Beta tape, with a full supply reel, measure the supply tension with the machine in either the Play or Record mode. (*see figs. 6 & 7*) The supply tension should measure 15 to 20 grams. The take-up tension should measure 55 to 110 grams. (*see figs. 6 & 8*)

   The Rewind (REW) Torque can be measured by stalling the tape where it comes out of the cassette (use a finger over a lint free cloth) and measure the tension that the machine is exerting on the tape. (*see fig. 9*) This tension should be 180 to 200 grams.

   By shuttling the tape onto the take-up reel (until nearly full), the F.F. torque can similarly be determined by stalling the tape where it comes out of the cassette and measuring the force (tension) at T/U exerted by the take-up reel. This tension should be 220 to 260 grams *(slightly off scale on the H7-UM). The non-stalled F.F. or REW tension should be 5 to 15 grams going into the cassette to assure proper tape packing without tape cinching, causing binding and edge damage.

# VHS

Recommended Gages
In Order of Preference . . .

1) T2-H7-UM
2) T2-H15-UM
3) T2-H5-ML
4) T2-H12-ML

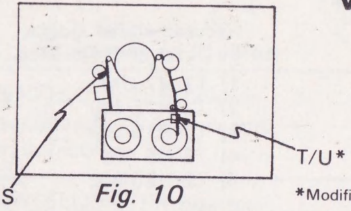


*Fig. 10*

*Modified cassette required.

1) Calibrate the TENTELOMETER on a sample of the ½" VHS tape, similar to the tape the gage will be used on in the machine. (*fig. 3*)
2) The basic quick check is for proper supply tension - this tension should measure 20 to 25 grams to assure interchangeability. *(fig. 10 & 12)* Hold the idler roller away from the tape path while inserting the gage.
3) With a modified cassette, (*see fig. 11 and paragraph 4 below*) tensions can be measured to check out the entire transport. The take-up tension should be 26 to 52 grams, using a 1 hour tape (2 hour LP). (*see fig. 10 & 13*).

   Fast forward (3 to 10 gms) and rewind tension (3 to 10 gms) can be measured directly using the modified cassette.

   Fast forward stall (100 to 125 gms) (*see fig. 15*) and rewind stall (65 to 80 gms) tension can also be measured using the modified cassette. Stall the tape using finger pressure over a clean lint free cloth where the tape comes out of the cassette and then insert the TENTELOMETER over the tape to measure the force the machine is exerting on the tape. This measurement replaces the torque gage readings. These readings replace all of the torque and fish scale measurements shown in the VHS service manual.
4) A modified cassette can be made from a 1 hour (2 hr. LP) VHS cassette by removing the front door of the cassette; prying off the top half of the take-up reel; (*see fig. 11 & 14*) and drilling and filing a hole in the cassette top cover to allow the gage to be inserted over the take-up side of the tape (after the pinch roller and capstan.) The recorder cassette chamber top cover must then be removed (4 screws) to allow access to the modified cassette during tension measurements. A shim ⅛" (.125") thick by 7 ⅝" (7.6") long is required (*see fig. 11 & 13*) on the Panasonic, RCA type machines to hold the cassette down in proper position when the cassette chamber top cover is removed.

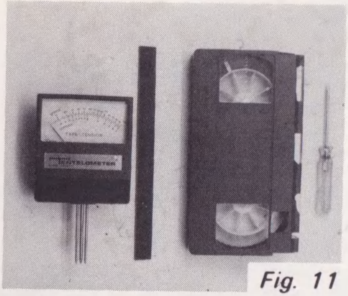


Fig. 11

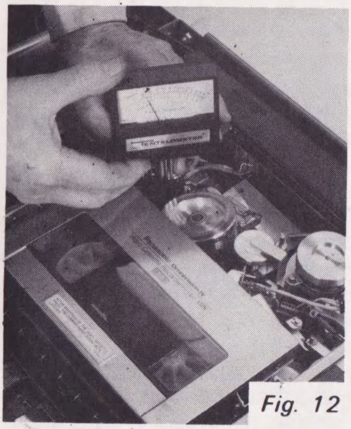


Fig. 12

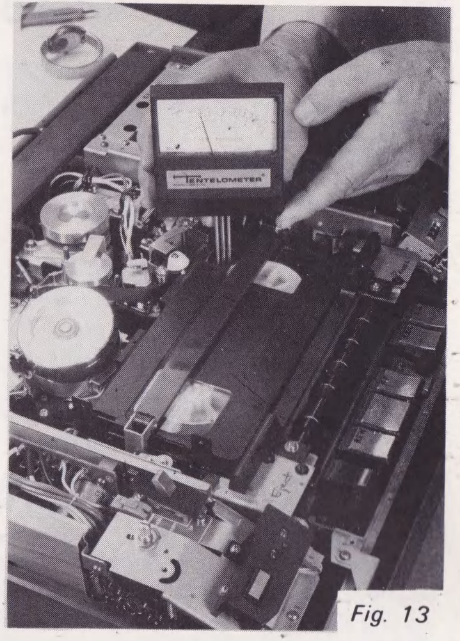


Fig. 13

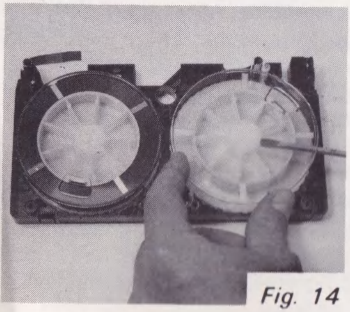


Fig. 14

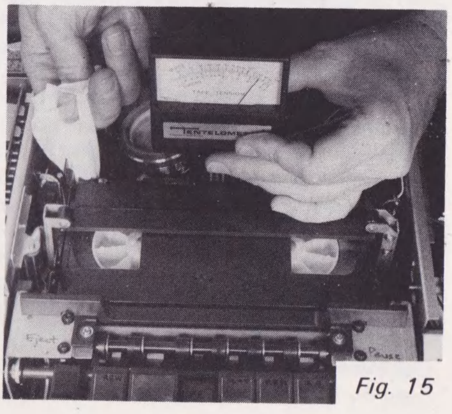


Fig. 15

# U-MATIC

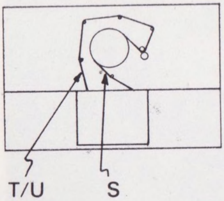


*Fig. 16*

JVC
PANASONIC
SONY 1000, 1200,
1600, 1800

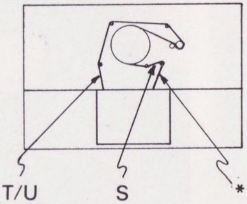


*Fig. 17*

SONY 2000
2600, 2800,
2850, 2860,
BVU200

* Do not measure supply hold back tension here.

Recommended Gages
In order of preference . . .

1) T2-H15-UM
2) T2-H7-UM
3) T2-H15-U
4) T2-H12-ML
5) T2H20-ML

1) Calibrate the TENTELOMETER on a sample piece of the ¾" U-matic tape similar to the tape it will be used on in the machine. (*fig. 3*)
2) The two basic quick checks are for Supply (S) and Take-up (T/U) tension. Errors in these two tensions are the major cause of interchangeability and tape eating problems.

**Supply (holdback) Tension:**

Holdback tension should measure 75 ± 5 grams just prior to entering the video heads. (You may allow this tension to be 60 to 90 grams prior to actual teardown and repair of the machine, but this will depend upon how close to specification you care to operate.) The supply tension should be steady since fluctuations during recording will cause horizontal instability impossible to match during playback. Errors in supply tension are the major cause of interchangeability problems.

**Take-up Tension:**

Take-up Tension is the major cause of tape eating since in some common machines the tension increases as the clutches wear. Ideally the T/U tension should measure 30 to 90 grams but rebuilding might be delayed until the T/U tension reaches 120 grams. (Anything above 150 grams is definitely dangerous for tape eating.)

# U-MATIC

**Some U-matics (Sony Type II) also allow the fast forward, rewind, and pay out tension to be easily measured.**

## Fast Forward Back Tension:

With a full one hour supply reel the "fast forward" back tension (measured by merely inserting the TENTELOMETER during F.F.) should be 80 to 90 grams. (Use 40 to 100 grams as rebuild limits.)

## Rewind Back Tension:

With the counter at 100 units, depress the "rewind" button and again insert the TENTELOMETER; the correct reading is 30 to 70 grams of tension. (use 20 to 80 grams as rebuild limits.)

## Pay-out Tension:

With a full supply reel, depress play and watch the area just entering the take-up reel for guides which move and may cause interference with the TENTELOMETER if it were inserted. If there are no guides to interfere, hit stop and allow tape to go back to the rest position. Carefully insert the gage onto the tape where it enters the take-up reel, press play and note the tension during pay-out. This tension should measure 25 to 60 grams. High tension causes tape "eating". (Rebuild if tension is over 95 grams.)

## Skew:

The skew control range can be checked using the TENTELOMETER. With the machine in play, (skew control is locked in center position during record) move the skew control to its extreme clockwise position, insert the TENTELOMETER to measure the minimum tension, then move the skew control to its extreme counterclockwise position and again insert the TENTELOMETER to measure its maximum tension. The purpose of the skew control is for matching the tension of the machine during playback to the tension the recorder induced originally, and thus reducing horizontal time base error. Proper range is from 50 gms to 100 gms.

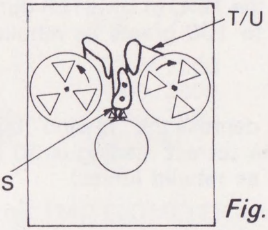
# ONE INCH VIDEO

There are numerous manufacturers and formats in the 1" tape width. Tentel cannot provide more than helpful tips in this area, since a compilation of all the specifications of the various machines would require more space than allocated. The newer SMPTE type "C" machines are undergoing final tension standards and thus it is best to double check with the service technician or service manual to verify the latest specifications.

Make sure the gage is calibrated on the type of tape on which tensions are to be measured.

## AMPEX

VPR 1, 2, 20



Recommended Gage T2-H20-MLD
Alternate Gages T2-H20-D2
T2-H20-ML
T2-H20-2

*Fig. 18*

It may be necessary to remove the trim cover at "S" in fig. 18. In the play mode the tension at "S" should be 4 to 4½ oz. (114 to 128 grams). The tension at "T/U" should be 14 ± 1 oz. (370 to 426 grams). In the still frame mode, the tension at "T/U" should be 4 to 5 oz. (114 to 142 grams). F.F. tension should be 12 ± 1 oz. and REW. Tension should be 10 ± 1 oz. measured just prior to going onto the respective reel.

## IVC (INTERNATIONAL VIDEO CORPORATION)

700, 800, 900, 1000 series machines.

Recomended Gage T2-H20-ML
Alternate Gages T2-H20-1
T2-H20-2
T2-H20-D2
T2-H15-UM

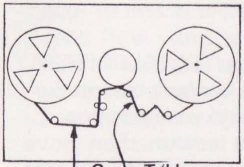


*Fig. 19*

Using a full 8" Supply reel, the tension at "S" in fig. 19, should measure 2.8 to 3.4 oz. (80 to 97 grams). The tension at "T/U" should measure 12 ± 1 oz. (310 to 370 grams). The Take-up Tension is of greatest importance since it effects the horizontal time base error.

The tension at "S" on the newer 1000 series (1070) etc) machines should measure 4.0 to 4.5 oz. using a full 8" diameter tape pack. The "skew" range in "play" measured at T/U should be 8 to 18 oz.

# ONE INCH VIDEO

## BOSCH FERNSEH

BCN 5,20,40,50

Recommended Gage T2-H20-1
Alternate Gages T2-H20-ML
T2-H20-2
T2-H20-D2
T2-H15-UM

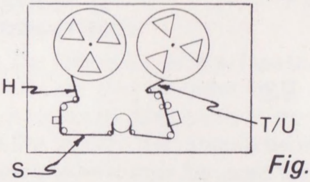


*Fig. 20*

There is only one factory recommended tension measurement position, and that is the tension prior to going into the scanning head, (*see "S" in fig. 20*). This tension is very important for interchange and horizontal time base error and should be 200 ± 20 grams.

You may want to monitor the tensions at both holdback ("H") and take-up ("T/U") in fig. 20, when the machine is new and keep an eye on these tensions as the machine is used. Significant changes or tensions above 450 grams on any 1" tape equipment should be brought to the attention of the factory service technician.

## SONY

BVH 500,1000,
1100

Recommended Gage T2-H12-MLD
Alternate Gages T2 - H20 - MLD
T2 - H20 - 2
T2 - H12 - 2
T2 - H12 - ML
T2 - H20 - ML
T2 - H15 - UM

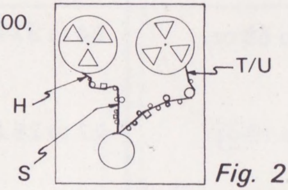


*Fig. 21*

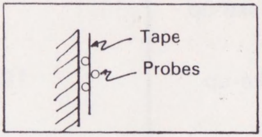


*Fig. 22*

Check with Sony for the latest tensions, however the following tensions represent the figures gained by actual test of several operating machines. The holdback tension "H" in fig. 21 should measure 70 to 100 grams; the head supply tension "S" in fig. 21, (*refer to fig. 22 for proper orientation of the TENTELOMETER probes*) should measure 80 to 90 grams. The Take-up tension, "T/U" in fig. 21, should measure 70 to 140 grams. Deviations from these ranges should be questioned, as interchangeability may suffer. These tensions are still undergoing minor changes to assure interchangeability and thus these values should be checked with your Sony service representative.

# QUAD 2" VIDEO

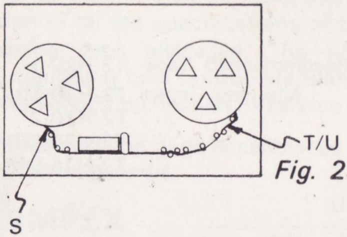


*Fig. 23*

Recommended Gages
In Order of Preference . . .

1) T2-H20-2
2) T2-H20-ML
3) T2-H20-D2

The older Ampex and RCA quad machines are of the constant torque rather than constant tension configuration. (*See audio section for explanation.*) The instructions provided by the Ampex manual show how to measure tension at a given diameter only (the bare hub). With the TENTELOMETER it is **not** necessary to remove the reels and wrap string around the hubs; also transient information can be obtained. Using the Torque-Tension calculations as explained in the audio section we can compute the following chart:

| MEASUREMENT LOCATION | FORCE AT STRING PER AMPEX INST. (Radius 1.5") | TORQUE IN (Inch-Ounces) |
|---|---|---|
| * Monentary Boost torque at Take-up reel | * 56 to 58 oz. | 84 to 87 in. -oz. |
| Normal Take-up Torque | 18 to 19 oz. | 27 to 28.5 in.oz. |
| Fast forward and Rewind Holdback Torque | 8 to 9 oz. | 12 to 13.5 in.oz. |
| Normal Holdback Torque | 8 to 9 oz. | 12 to 13.5 in.oz. |
| * Holdback brakes and Take-up brakes | * 24 ± 1 oz.<br>* 120 ± 5 oz. | 34.5 to 37.5 in.oz.<br>172.5 to 188 in. oz. |

# QUAD 2" VIDEO

Knowing the Torque allows us to calculate the tension at any point along the tape length using:

Tension = Torque/Radius

Merely measure the diameter of the tape pack at the point the tension reading is made, divide the diameter by 2 to get the radius, and then divide the radius into the torque (given in in.-oz.) to get the proper tension in *ounces.* This is the tension that should be read on the TENTELOMETER.

Following is a graph which may be used for determination of the *proper* Holdback or Takeup tension readings for various pack diameters, without resorting to calculations. Measure the tape pack diameter on the tape reel where the holdback or take-up tension will be measured, follow this diameter up to the hold-back or take-up zone on the graph (depending upon whether hold-back or take-up tension is desired) and then read the proper TENTELOMETER (tension) reading on the vertical axis.

EXAMPLE: If the holdback tension is measured with a pack diameter of 5 inches (near empty reel), the proper TENTELOMETER tension reading would be approximately 5 ounces.

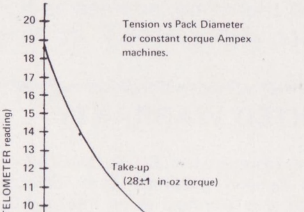


*Fig. 24*

* It is recommended that these measurements be made with the pull scales supplied with the recording equipment.

# REPAIR/SERVICE

If the unit cannot be calibrated on a sample of tape with a known weight using the calibration adjust screw, the TENTELOMETER should be returned to the factory for repair. Field repair should not be attempted as severe damage will result from improper internal adjustments and opening the unit damages the case and voids the possibility of warranty repair work.

The unit should be returned, shipping prepaid, to:

**Tentel Corporation**
1506 Dell Avenue
Campbell, CA 95008
Attn: Repair Department
Telephone: (408) 379-1881
✱1-800-538-6894

Please include a brief description of the probable cause and/or symptom of the problem.

Tentel shall have sole responsibility to determine warranty repair. Most non-warranty work can be expedited by enclosing an authorized order specifying "repair work not to exceed $100 , or if an order has not been included, an estimate will be sent to enable an order to be issued to start repair work. Please furnish the name, address and phone number of the person to whom correspondence should be directed for questions regarding the unit.

## LIMITED WARRANTY

With proper care, handling and storage your TENTELOMETER should provide years of trouble free, accurate tape tension readings. The TENTELOMETER Model T2 mechanical tape tension gage is guaranteed to be free of defects in materials and workmanship for a period of one year after delivery to the initial purchaser.

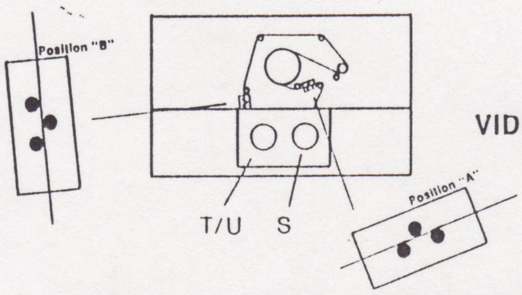
NOTE: This warranty does not cover damage caused by accident, abuse, alteration, disassembly or failure to follow instructions. Tentel assumes no responsiblility or liability beyond the purchase price of the unit.

The Tape Tips and Instruction Manual is intended as a helpful guide only and Tentel assumes no liability from its misuse or misapplication.

**TENTEL**

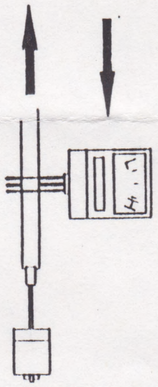
# SECTION 7 - CALIBRATING THE TENTELOMETER® FOR GREATEST SINGLE POINT ACCURACY ON MODELS WITHOUT BALL BEARING ROLLERS (UM, ML, A)

Models without ball bearing rollers can likewise be field "calibrated" for extremely close tolerances at any one point with the aid of the calibration weight set. This calibration must however, take into account the tape back coating, tape direction, tape speed, and the direction from which the tension acts. Examples:



These factors can be simulated for TENTELOMETER® calibration as follows:

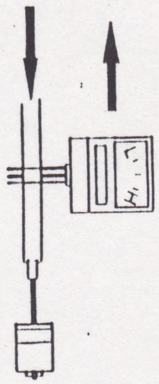
Video: Position A:
- Back Coating rubs on the outer probes.
- Tape direction is from High scale toward zero.
- Tape speed is low.
- The tension force acts from the supply reel brake (The high side of the scale).



This can be simulated by holding the gauge in the right hand (putting the force on the high side of the scale), pulling a sample of the tape upwards, at a slow steady speed, with the back coating facing us to rub the outer probes.

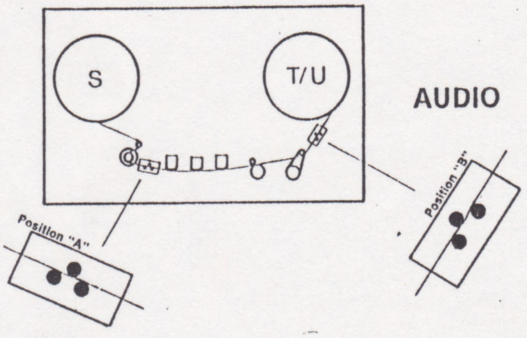
Rotate the "zero" adjust screw so that the weight (3 oz. for U-Matic) causes a reading of 3 ounces on the TENTELOMETER® scale. The accuracy is now set to within 2% at the 3 ounce position.

Video: Position B:
- Back coating now rubs on the center probe.
- Tape direction is now from zero to high scale.
- Tape speed is *still* low.
- The tension force acts from the take-up reel brake (The high side of the scale).

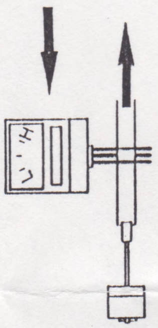


For maximum accuracy, the gauge would now be held in the right hand to place the force on the high end of the scale, the tape would go *down* thru the probes, and the tape back coating would face away from us toward the center probe.

Again turn the "zero" adjustment screw so that the TENTELOMETER® reads the value of the weight suspended on the tape.

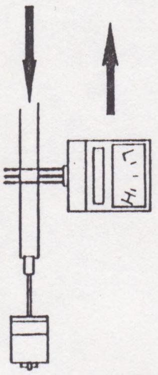


Audio: Position A:
- Back coating rubs on outer probes.
- Tape direction during play or record is from zero to high scale.
- Tape speed is low.
- Tape tension force acts from the holdback supply reel brake. (The zero side of the scale).



This can be simulated by holding the gauge in the left hand (putting the force on the zero side of the scale), pulling the tape upwards, at a slow steady speed, with the back coating facing us to rub the outer probes. Turn the "zero" adjust screw so that the gauge reading agrees with the weight suspended on the tape.

Audio: Position B:
- Back coating rubs on outer probes.
- Tape direction is now from zero to high scale.
- Tape speed is low.
- The tension force now acts from the take-up reel brake (The high side of the scale).



This can be simulated by holding the gauge in the right hand (putting the force on the high end of the scale), move the tape downward through the probes at a low steady speed and with the back coating facing us to rub the outer probes.

Again turn the "zero" adjustment screw so that the gauge reading agrees with the weight suspended on the tape.

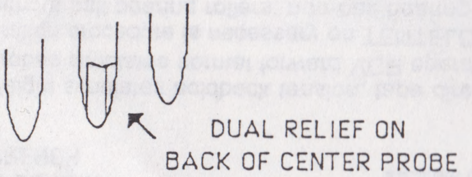
Probably the hardest concept to grasp with this technique is: "What direction" the tension is acting from; in general, the tension acts on the gauge on the side opposite to the pinch roller/capstan. The logic used in these examples should enable the standard non ball bearing probe model TENTELOMETER® to be set up at any particular point to yield extremely close tension readings.

**TENTEL MODEL:** T2-H15-SLC

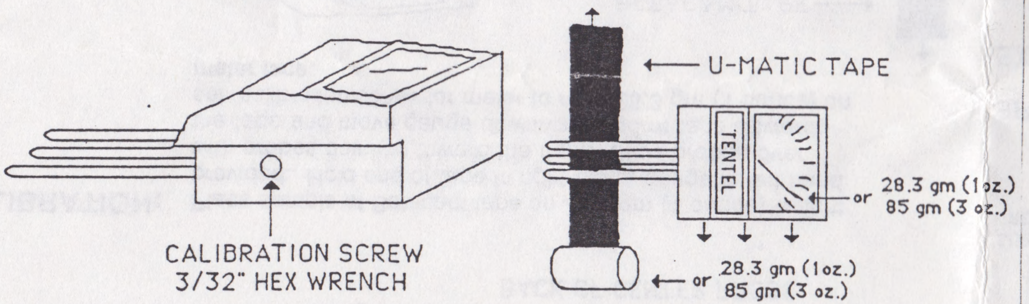
**SCALE:** 0 - 420 grams (0 - 15 ounces)

**APPLICATION:** U-Matic (will also work fairly well on VHS and Betacam™)

**PROBES:** SLC, long probes with special hard chrome plating over 303 stainless steel; center probe has a special "C" relief to allow safe insertion of probes at inlet to video drum.

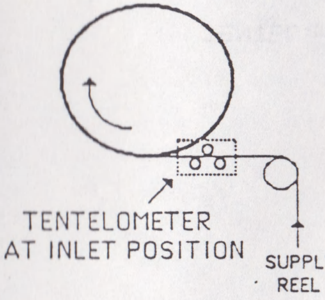


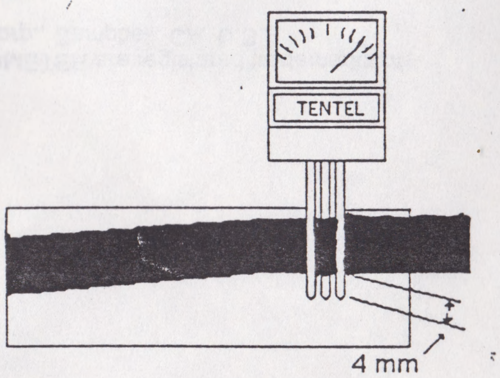
**CALIBRATION:** Place sample of U-Matic tape on 28.3 gm (1 ounce ) weight provided, or on 85 gm (3 oz.) weight if available. Hold end of tape in left hand, gauge in right hand with probes pointing toward the left. Slide probes over tape and move gauge downward and/or tape upward; set calibration screw for meter to read 28.3 gm (1 ounce) on meter face or 85 gm (3 oz.) if larger weight was used.



**NOTE:** Weight simulates holdback tension, tape direction through probes simulates normal forward VCR operation. This calibration procedure is necessary on TENTELOMETER® models without ball bearing rollers; non ball bearing models required for very small spaces and low cost.

**APPLICATION:** Using normal U-Matic cassette, place VCR in FWD mode. Insert TENTELOMETER® carefully over tape directly at inlet location allowing probes to extend approximately 4 mm (1/8" ) below bottom of tape. It may be necessary to remove the impedance fan on the inlet guide on Sony Type 7 & 9 VCR's. Hold gauge vertical and move gauge back and forth slightly to obtain minimum reading (without center probe touching video drum). With practice it is usually possible to simply hold the gauge in the location required for proper insertion, to obtain the correct reading. **NOTE:** The special "C" relief allows the center probe to contact the spinning video drum without harm to the fragile head tips, or to the probe.





**SPECIFICATION:** Tension at the inlet location should be 75 ± 5 gm (70 to 80 gm)

**EXTRA:** The performance of the Tension servo can be checked using first a cassette with a full supply reel and comparing the tension to that obtained with a nearly empty supply reel. The tension should be fairly constant regardless of the amount of tape on the supply reel.

The tension range of the skew control can also be measured by the tension at either extreme of the skew.

Many of the other running tape tensions can be similarly measured; Take-up, FF, REW, Reverse, etc. Tentel has a durable, accurate motor driven dial torque gauge for the brake and clutch torques to replace the "dummy" reel and spring scale method. The torque gauge fits onto the top of the spindles and reads directly in gm-cm.

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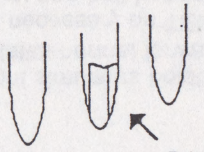
**TENTEL MODEL:** T2-H7-UMC

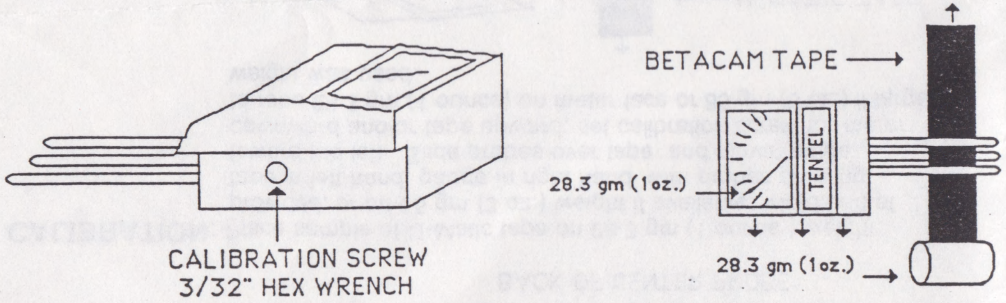
**SCALE RANGE:** 0 to 240 grams, (0-7 ounces)

**APPLICATION:** Betacam™ (will also work fairly well on VHS and some older U-Matic VCR's)

**PROBES:** UMC Special hard chrome plating over 303 stainless steel; center probe has special "C" relief to allow safe insertion of probes at inlet to video drum.

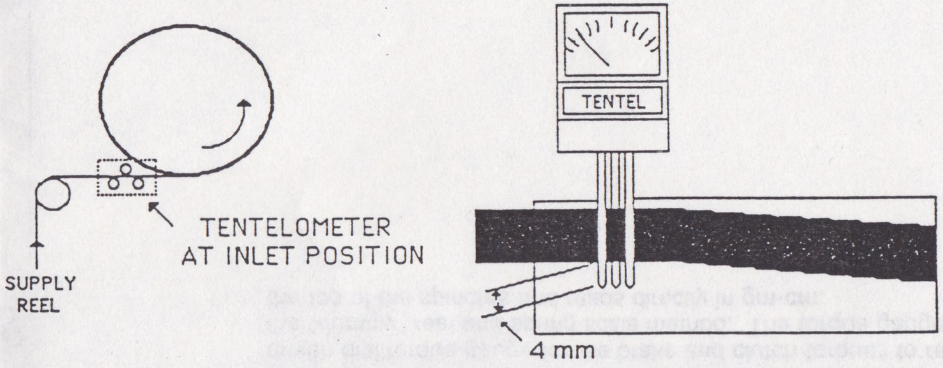


**CALIBRATION:** Place sample of Betacam tape on 28.3 gm (1 ounce) weight provided. Hold end of tape in right hand, gauge in left hand with probes pointing toward the right. Slide probes over the tape and move gauge downward and/or tape upward; set calibration screw for meter to read 28.3 gm (1 ounce) on meter face.



**NOTE:** Weight simulates holdback tension, tape direction through probes simulates normal forward VCR operation. This calibration procedure is necessary on TENTELOMETER® models without ball bearing rollers; non-ball bearing models required for very small spaces and low cost.

**APPLICATION:** Using normal Betacam cassette, place VCR in FWD mode. Insert TENTELOMETER carefully over tape directly at inlet location allowing probes to extend approximately 4 mm (1/8") below bottom of tape. Hold gauge vertical and move gauge back and forth slightly to obtain minimum reading (without center probe touching video drum). With practice it is usually possible to simply hold the gauge in the location required for proper insertion, to obtain the correct reading. **NOTE:** The special "C" relief allows the center probe to contact the spinning video drum without harm to the fragile head tips, or to the probes.



**SPECIFICATION:** Tension at the inlet location should be 45 ± 5 gm (40 to 50 gm).

**EXTRA:** The performance of the tension servo can be checked using first a cassette with a full supply reel and comparing the tension to that obtained with a nearly empty supply reel. The tension should be fairly constant regardless of the amount of tape on the supply reel. Many of the other running tape tensions can be similarly measured; Take-up, FF,REW, Reverse, etc. TENTEL has a durable, accurate dial torque gauge for the brake and clutch torques to replace the "dummy" reel and spring scale method. The torque gauge fits onto the top of the spindles and reads directly in gm-cm.

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